Forces:

- Newton's Laws
- They are vectors. → break into components
- Equations:

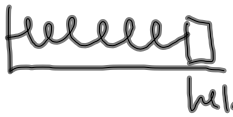
$$\Sigma \vec{F} = m\vec{a}$$

$$F_{fs} = \mu_s F_N$$

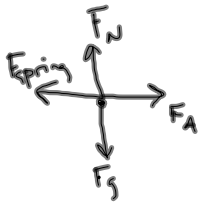
$$F_{fk} = \mu_k F_N$$

$$F = -kx$$

- Spring scenario:



held in place by 100 N
$k = 100\ N/m$
what is distance stretched?



$$\Sigma F_x = 0$$
$$F_A - F_{spring} = 0$$
$$kx = F_A = 100\ N$$
$$x = 1\ m$$

- Use x- and y-directions independently

Springs:

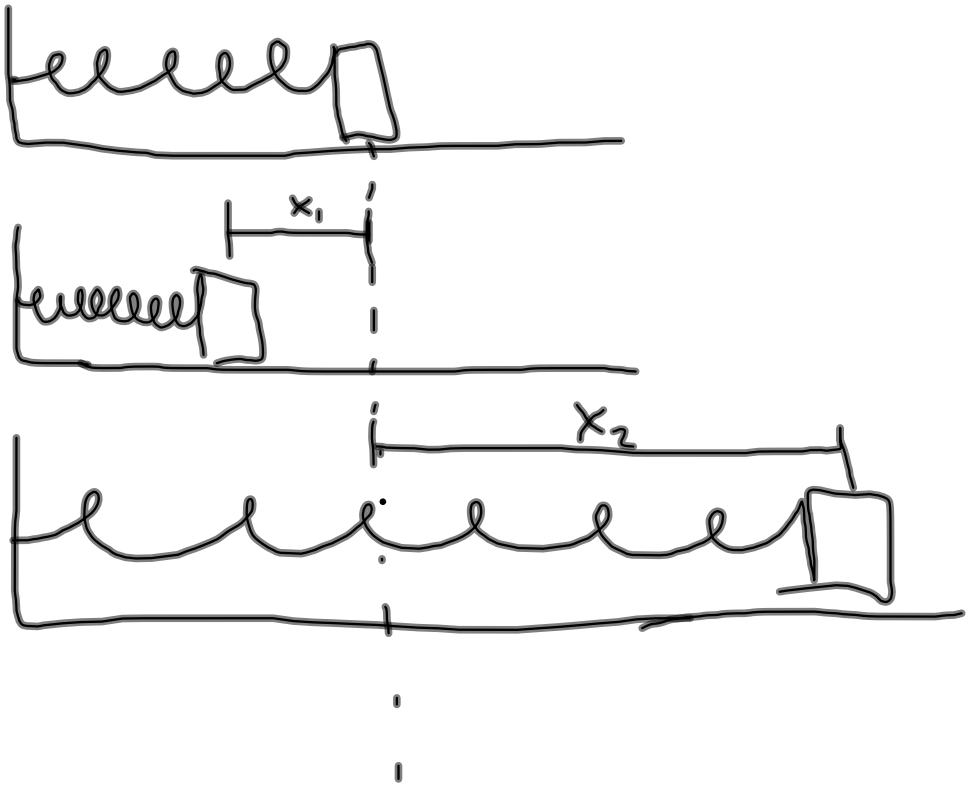
Hooke's law:

$$F = -kx$$

↳ negative to show it is a "restoring force"

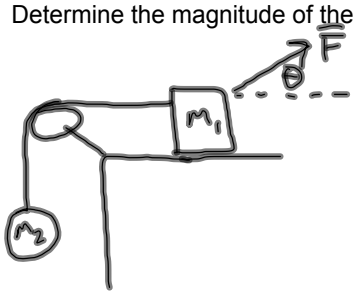
k = spring constant

x = distance extended or compressed from unstrained length



Forces Review and Practice Problem AP Physics 9.19.11

A block of mass m_1 on a rough, horizontal surface is connected to a ball of mass m_2 by a lightweight cord over a lightweight, frictionless pulley. A force of magnitude *F* at an angle theta with the horizontal is applied to the block as shown and the block slides to the right. The coefficient of kinetic friction between the block and surface is mu_k. Determine the magnitude of the acceleration of the two objects (in variables).



$$a = \frac{F(\cos\theta + \mu_k \sin\theta) - (m_2 + \mu_k m_1)g}{m_1 + m_2}$$

$$\sum \bar{F}_x = m\bar{a}$$

$$F_A \cos\theta - F_{fk} - F_T = (m_1 + m_2)a$$

$$F_A \cos\theta - (\mu_k m_1 g - \mu_k F_A \sin\theta)$$

$$-(m_2 g) = (m_1 + m_2)a$$

$$\sum \bar{F}_y = 0$$

$$F_N + F_A \sin\theta - F_g = 0$$

$$F_N = F_g - F_A \sin\theta$$

$$F_{fk} = \mu_k F_N$$

$$= \mu_k (F_g - F_A \sin\theta)$$

$$= \mu_k m_1 g - \mu_k F_A \sin\theta$$